Claims

What is claimed is:

1. An apparatus for measuring the gas volume fraction process flow flowing within a pipe, the apparatus comprising:

at least one sensor for providing a sound measurement signal indicative of the speed of sound propagating within the pipe; and

a processor for determining the gas volume fraction of the flow, in response to the sound measurement signal.

2. The apparatus of claim 1, wherein the at least one sensor includes at least two pressure sensors at different axial locations along the pipe, each of the pressure sensors providing a respective pressure signal indicative of a pressure disturbance within the pipe at a corresponding axial position.

3. The apparatus of claim 1, wherein the process flow is one of a liquid having entrained gas, a mixture having entrained gas, and a slurry having entrained gas.

4. The apparatus of claim 1, wherein the processor determines the slope of an acoustic ridge in the k-w plane to determine the speed of sound propagating through the process flow flowing in the pipe.

5. A method of measuring the gas volume fraction process flow flowing within a pipe, the method comprising:

measuring the speed of sound propagating within the pipe; and

determining the gas volume fraction of the flow, in response to the measured speed of sound.

6. The method of claim 5 further comprises providing at least one sensor for measuring the speed of sound propagating within the pipe

7. The method of claim6, wherein the at least one sensor includes at least two pressure sensors at different axial locations along the pipe, each of the pressure sensors providing a respective pressure signal indicative of a pressure disturbance within the pipe at a corresponding axial position.

8. The method of claim 1, wherein the process flow is one of a liquid having entrained gas, a mixture having entrained gas, and a slurry having entrained gas.

9. The method of claim 1 further includes determining the slope of an acoustic ridge in the k-ω plane to determine the speed of sound propagating through the process flow flowing in the pipe.